

Mechanism of action of poisons

A **Poison** is a substance that, when administered in small quantities, causes disease-like changes or death based on its chemical properties. Poisons act in the body through various mechanisms:

▪ Etching

This term refers to local denaturation of tissue components by caustics, i.e. strong acids with $pK < 2$, e.g. H_2SO_4 , HCl or HNO_3 sub>, or strong bases (lyes) with $pK > 11.5$, e.g. $NaOH$, KOH , NH_4OH .

 For more information see *Ingestion of Acids and Alkalies*.

▪ Covalent non-specific interactions with biomolecules (proteins, nucleic acids and polysaccharides).

Example of these poisons are very reactive aldehydes. Aldehyde group $-CHO$ reacts willingly with amino group $-NH_2$ or sulfhydryl group $-SH$, occurring abundantly in proteins. An example is methanal (formaldehyde) $HCHO$, its aqueous saturated solution is known as formalin.


▪ Violation of acid-base balance.

Some poisons disrupt the acid-base balance of the organism<ref>E-course on acid-base balance at university MOODLE (<https://dl1.cuni.cz/course/view.php?id=110>)< /ref>. Ethylene glycol is oxidized by alcohol dehydrogenase to glycolic, glyoxalic, and oxalic (oxalic) acids, which cause metabolic acidosis. Salicylates stimulate the respiratory center. The resulting hyperventilation leads to respiratory alkalosis. After these substances enter the cells, they turn off oxidative phosphorylation in the mitochondria, decrease ATP production, block citrate cycle enzymes and stimulate anaerobic glycolysis. The result is overproduction and accumulation of acidic metabolites, mainly lactate, pyruvate and acetoacetate, and thus metabolic acidosis develops.

 For more information see *Alcohol intoxication#Ethylene glycol*.

▪ Effect on Membranes

Ethanol, detergents and hydrocarbons change the fluidity of the membranes, which is reflected in the function of the membrane components. Changes in membrane microviscosity will change the conformation of membrane channels, receptors and enzymes, thereby disrupting their functions (membrane transport, information transfer, membrane potential). Fluidity of membranes is a control mechanism for heavy metal absorption.

 For more information see *Alcohol intoxication*.

▪ Interaction with the transfer of oxygen in the organism

1. Binding of poison to hemoglobin

 For more information see *Carbon monoxide poisoning*.

2. Oxidation of hemoglobin to methemoglobin

 For more information see *Intoxication by methemoglobinizing substances*.

3. Inhibition of cytochrome oxidase

 For more information see *Hydrogen cyanide and cyanide intoxication*.

▪ Inhibition of enzymes

1. Non-specific interactions, binding to sulfhydryl group $-SH$.
2. Binding of the poison to the active site of the enzyme.

▪ Interaction with specific receptors and disruption of cell signaling or membrane channel function.

Sodium channel, nicotinic and muscarinic receptors, psychopharmaceuticals, addictive substances.

Links

Literature

References

ws: Mechanismus účinku jedů